

WHAT IS CLAIMED IS:

1. A manufacturing method of an electric device having a wiring connection structure, comprising steps of:

5 (a) forming a wiring on a substrate;

(b) forming an interlayer insulating film with covering said wiring;

(c) forming on an upper surface of said interlayer insulating film a mask material having a pattern that exposes a portion of said upper surface of said interlayer insulating film above said wiring;

10 (d) performing an anisotropic etching with employing said mask material as an etching mask, so that said interlayer insulating film is removed to form a concave part, and according to this, said wiring is exposed;

(e) removing said mask material;

(f) forming a conductive film on a structure obtained by said step (e) with
15 filling up said concave part;

(g) removing said conductive film of a part which is formed on said upper surface of said interlayer insulating film; and

(h) cleaning a surface of a structure obtained by said step (g) with employing a cleaning solution which has the property of dissolving a material of said wiring, wherein

20 in said step (d), by performing said anisotropic etching with employing a predetermined etching gas, a side wall of said concave part has a smooth shape without a microscopic unevenness in a vicinity of said upper surface of said interlayer insulating film at least.

25 2. The manufacturing method of the electronic device having the wiring

connection structure according to claim 1, wherein

said predetermined etching gas is a mixed gas of C_4H_8 , O_2 and Ar.

3. The manufacturing method of the electronic device having the wiring
5 connection structure according to claim 1, wherein

said step (f) includes steps of:

(f-1) forming a barrier metal film composed of a material which has solubility
to said cleaning solution; and

(f-2) forming a metal film on said barrier metal film, wherein

10 in said step (d), a depth of said concave part is set to be a depth that said barrier
metal film formed on a side surface of said concave part by said step (f) is not completely
dissolved by a cleaning in said step (h).

4. The manufacturing method of the electronic device having the wiring
15 connection structure according to claim 1, wherein

said wiring includes:

a metal film composed of a material which has solubility to said cleaning
solution; and

a top layer film which is formed on said metal film and composed of a material
20 which does not have solubility to said cleaning solution, wherein

in said step (d), said anisotropic etching is stopped when said top layer film is
exposed.

5. The manufacturing method of the electronic device having the wiring
25 connection structure according to claim 1, wherein

said wiring includes:

a metal film composed of a material which has solubility to said cleaning solution; and

a top layer film which is formed on said metal film and composed of a material
5 which does not have solubility to said cleaning solution, wherein

in said step (d), said anisotropic etching is stopped in process of etching said top layer film.